

REMARKS

Applicants respectfully request reconsideration of the present application in view of the foregoing amendments and in view of the reasons that follow.

Status of Claims:

Claim 71 is currently being cancelled.

Claims 28, 61, 62 and 72 are currently being amended.

No claims are currently being added.

This amendment and reply amends and cancels claims in this application. A detailed listing of all claims that are, or were, in the application, irrespective of whether the claims remain under examination in the application, is presented, with an appropriate defined status identifier.

After amending and canceling the claims as set forth above, claims 28, 61, 62, 68, 70 and 72-76 are now pending in this application for further consideration, whereby claims 25-27, 29-60, 63-67 and 69 are withdrawn from consideration.

Comments Concerning Election/Restriction:

On page 2 of the Office Action, it asserts that Applicants' election of Group II claims is acknowledged, and that Applicants' status identifies (i.e., all 'original') did not properly indicate the 'withdrawn' claims. These comments are not completely understood, since at the time the reply was filed on June 28, 2005, there was only a restriction of claims 1-24, whereby those claims were canceled in that reply. Only **after** the reply was filed on June 28, 2005, did the PTO issue a two-way election of species. In this amendment and reply, the claims are provided with their correct designations.

Objection to Specification:

In the Office Action, the specification was objected to because of several informalities noted on page 2 of the Office Action. By way of this amendment and reply, those informalities have been corrected.

Claim Rejections – Indefiniteness:

In the Office Action, claims 72 and 76 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite, for the reasons set forth on page 3 of the Office Action. By

way of this amendment and reply, claim 72 has been amended to address this indefiniteness rejection, whereby presently pending claims 72 and 76 (which depends from claim 72) are believed to fully comply with 35 U.S.C. § 112, second paragraph.

Claim Rejections – Prior Art:

In the Office Action, claim 28 was rejected under 35 U.S.C. § 102(b) as being anticipated by Meuris et al. (“The Relationship of the Silicon Surface Roughness and Gate Oxide Integrity . . .”); claims 61, 62, 73, 74 and 75 were rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 6,348,157 to Ohmi et al. (“Ohmi ‘157”); claims 72 and 76 were rejected under 35 U.S.C. § 102(b) as being anticipated by, or, in the alternative, under 35 U.S.C. § 103(a) as being unpatentable over Ohmi ‘157 in view of NN9201295 (“IBM Technical Disclosure Bulletin, Jan. 1, 1991); claims 68 and 75 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohmi ‘157 in view of Miyashita et al. (“Dependence of Thin Oxide Films Quality on Surface Micro-Roughness”); claim 71 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Ohmi ‘157 in view of Applicant’s Admitted Prior Art (AAPA, page 4); and claim 70 was rejected under 35 U.S.C. § 102(b) as being unpatentable over Ohmi ‘157 in view of U.S. Patent No. 6,350,322 to Yates. These rejections are traversed with respect to the presently pending claims under rejection, for at least the reasons given below.

Claim 28:

Independent claim 28 includes steps of cleaning a silicon surface and oxidizing the cleaned silicon surface in an atmosphere of oxygen radicals (namely, an oxygen radical atmosphere) to form an oxide film which serves as a self-sacrifice film. These steps are described on page 20, lines 2 to 7 of the specification. Such oxidization in an atmosphere of the oxygen radicals is very effective for improving flatness after removal of the oxide film, as described on page 22, lines 7 to 15 of the specification, with reference to Figure 5 of the drawings.

Turning now to the cited art of record, Meuris et al., page L1514, the right-hand column to page L1515, the left-hand column states that “4 wafers that underwent the complete RCA cleaning for each cleaning condition were combined and were processed together in a thermal oxidation furnace to grow a 15 nm gate-oxide. The oxide was grown in

dry O₂ ambient (without addition of any chlorine) at a temperature of 900°C in a double-furnace.”

As mentioned in the above-description of Meuris et al., it is very clear that no oxide is grown in an oxygen radical atmosphere, but rather oxide is grown in a dry O₂ ambient atmosphere. In addition, no disclosure is made at all in Meuris et al. about forming an oxide film in an oxygen radical atmosphere.

Accordingly, claim 28 is not anticipated by Meuris et al.

Claim 61:

Independent claim 61 recites terminating a silicon surface by deuterium. Terminating a silicon surface by deuterium provides for excellent stability as compared with terminating with hydrogen, because deuterium has a weight equal to twice that of hydrogen.

Ohmi '157 does not teach the use of deuterium for terminating a silicon surface.

Furthermore, it is to be noted that there is no teaching at all in Ohmi '157 about cleaning a (110) substrate. Rather, cleaning an n-type (100) silicon substrate (embodiments 3, 5, 7, 8, 9, 10) or an n-type (111) silicon substrate (embodiments 4, 11, 12) is discussed in Ohmi '157.

On the other hand, the substantial (110) crystal plane orientation according to the specification includes (111) crystal plane orientation, as described at the bottom few lines on page 7 of the specification.

As recited in presently pending claim 61, that claim recites a step of “preparing a silicon semiconductor surface which has a (110) plane as a predetermined crystal plane orientation”, whereby this clearly does not include the substantial (110) crystal plane as described on page 7 of the specification.

Accordingly, claim 61 is patentable over the cited art of record.

Claim 72:

With respect to independent claim 72, a processing step is carried out by the use of a cleaning solution containing HF and H₂O, in which dissolved oxygen is of a concentration of less than 100ppb in that solution.

Turning now to the cited art of record, Ohmi '157 describes cleaning a substrate by using ultrapure water, as mentioned in column 5, line 66 to column 6, line 2 of that reference. On the other hand, NN9201295 discloses deoxygenated HF acid solutions for precleaning of silicon wafers.

However, no teaching is made in either Ohmi '157 or in NN9201295 about cleaning a silicon surface using an HF and H₂O solution with dissolved oxygen of less than 100ppb.

Please also note that the methods according to the independent claims 61 and 72 are especially effective to clean a surface having the (110) crystal plane orientation and to obtain a flattened (110) surface.

Accordingly, presently pending claim 72 is patentable over the cited art of record.

Dependent Claims:

The other claims under rejection depend from one of the independent claims discussed in detail above, and thus are patentable for at least the reasons given above.

Conclusion:

Since all of the issues raised in the Office Action have been addressed in this Amendment and Reply, Applicants believe that the present application is now in condition for allowance, and an early indication of allowance is respectfully requested.

The Examiner is invited to contact the undersigned by telephone if it is felt that a telephone interview would advance the prosecution of the present application.

The Commissioner is hereby authorized to charge any additional fees which may be required regarding this application under 37 C.F.R. §§ 1.16-1.17, or credit any overpayment, to Deposit Account No. 19-0741. Should no proper payment be enclosed herewith, as by a check or credit card payment form being in the wrong amount, unsigned, post-dated, otherwise improper or informal or even entirely missing, the Commissioner is authorized to charge the unpaid amount to Deposit Account No. 19-0741.

If any extensions of time are needed for timely acceptance of papers submitted herewith, Applicants hereby petition for such extension under 37 C.F.R. §1.136 and authorize payment of any such extensions fees to Deposit Account No. 19-0741.

Respectfully submitted,

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